Nox Control Procedures Stoker Calciner Furnaces CA-1 and CA-2

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Solvay Minerals, Inc.

Based on Detroit Stoker Company CFD Modeling, Job No. ES-111

1. Nox Reduction Technologies

1.1 Basic System, with Revised Original Overfire Air (OFA) Configuration

a. General Description. The original conventional overfire and tempering air furnace design was optimized with reduced lower furnace section stoichiometry, allowing complete combustion higher up in the furnace. This system emulates a conventional boiler overfire air system and provides better mixing.

b. Equipment. Higher pressure overfire air headers and nozzles, including automatic control dampers and overfire air fan, were optimized with Computation Fluid Dynamic (CFD) modeling. There are three rows of overfire air nozzles in the front (stoker side) of the furnace and three rows in the rear. Nozzle locations are shown in Figure “2E”.

c. Process. Air requirement is 45,000 ACFM at 80F and 20 inches WC, for each furnace. Nox emission according to the CFD model is 0.79 lb/MM Btu. The CFD model Figure “2E” shows the effect on Nox concentrations in various areas of the furnace.

d. Control. Overfire air will be controlled proportional to fuel flow with optimization to control other furnace factors including temperature, slag and Nox emission rate. Solvay’s existing distributed control system computers (DCS) will be used.

1.2 Flue Gas Recirculation (FGR)

e. General Description. Calciner flue gas, after the electostatic precipitor but before the calciner ID fan, will be diverted and injected into several locations to reduce Nox by reducing the furnace temperature and displacing oxygen.

f. Equipment. A fan will be used to return the flue gas to the furnace. The majority of the flue gas will be ducted to the undergrate chamber. A small percentage will be ducted to the coal feeder distributor area and the remaining will be ducted to the lower rear overfire air nozzles. Each of the FGR headers will have automatic flow control dampers.

g. Process. The quantity of FGR, which will be at the temperature of the calciner offgas of 400F, will be 30% in terms of flue gas produced by the furnace. Furnace outlet temperature will be reduced more than 100F. Nox emissions according to the CFD model and Detroit Stoker's estimate will be reduced 34% to 0.52 lb/MM Btu. The CFD model Figure "4E" shows the effect on reducing Nox concentrations in various areas of the furnace.

h. Control. FGR flow will be controlled proportionally with the coal and trona ore feed rates using the DCS system. Furnace temperature, slag conditions, and Nox emission will be factored into the control program.

1.3 Water Injection (WI)

i. General Description. OFA and FGR are supplemented with water injection to reduce Nox by lowering the flame temperature and displacing oxygen.

j. Equipment. The front and rear walls of the furnace will each have a common header with one control solenoid valve per four spray nozzles. Water injection spray nozzles were modeled to be located as shown in Figure "3E", below the OFA nozzles.

k. Process. Water flow requirement is 10 GPM in the rear and 5 GPM in the front. Furnace outlet temperature is reduced approximately 100F. Nox emissions according to the CFD model and Detroit Stoker's estimate will be further reduced 13.5% to 0.45 lb/MM Btu. The CFD model Figure "3E" shows the effect on reducing Nox concentrations in various areas of the furnace.

l. Control. Water flow will be controlled by the DCS system, proportional to coal feed rate, furnace temperature, slag condtions, and Nox emission.